AN AJSS

An Asian Journal of Soil Science

Volume **11** | Issue 1 | June, 2016 | 187-190 | e ISSN–0976–7231 ■ Visit us : www.researchjournal.co.in

Research Article

DOI : 10.15740/HAS/AJSS/11.1/187-190

Effect of integrated nutrient management on the growth and yield of senna in coastal sandy soil

■ R. SINGARAVEL, D. ELAYARAJA **AND** K.VISWANATHAN

Received : 11.03.2016; **Revised :** 18.04.2016; **Accepted :** 14.05.2016

MEMBERS OF RESEARCH FORUM:

Corresponding author :
R. SINGARAVEL, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar, CHIDAMBARAM (T.N.) INDIA
Email: singar_vel@yahoo.co.in

Co-authors :
D. ELAYARAJA AND K.VISWANATHAN, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar, CHIDAMBARAM (T.N.) INDIA

Summary

To increase the production of medicinal senna in sandy soils of coastal agro ecosystem, integrated nutrient management treatments involving inorganic fertilizers, organic manures namely FYM, vermicompost, humic acid and microbial consortium were evaluated. The intial soil was typic udipsamments and represented sandy texture and non-saline nature. In Completely Randomized Design, the following treatments were evaluated with three replications using senna as test crop. T_1 - Absolute control, T_2 – Recommended NPK, T_3 – FYM alone @ 12.5 t ha^{-1}, T_4 – Vermicompost alone @ 4.0 t ha^{-1} , T_5 – 75 % NPK + FYM @ 12.5 t ha^{-1}, T_6 - 50 % NPK + FYM @ 12.5 t ha^{-1}, T_7 - 75 % NPK + vermicompost @ 4.0 t ha^{-1}, T_8 – 50 % NPK + vermicompost @ 4.0 t ha^{-1}, T_9 – T_5 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3 %, T_{10} – T_6 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3% , T_{11} – T_7 + $ZnSO_4$ @ 25 kg ha^{-1} +Humic acid foliar spray @ 0.3% , T_{12} – T_8 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3% . Bio inoculants, *Azospirillum* and phosphobacterium were applied to all the treatments excluding absolute control and recommended NPK. The results of the study indicated that the application of INM significantly improved the growth and yield of senna in coastal sandy soil. Among the treatments, application of 75 % NPK fertilizer + vermicompost @ 4.0 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} with humic acid foliar spray ranked best in recording the higher growth character, leaf and pod yield of senna and available soil nutrients.

Key words : Senna, Integrated nutrient management, Sandy soil

How to cite this article : Singaravel, R., Elayaraja, D. and Viswanathan, K. (2016). Effect of integrated nutrient management on the growth and yield of senna in coastal sandy soil. *Asian J. Soil Sci.*, **11** (1) : 187-190 : **DOI : 10.15740/HAS/AJSS/11.1/187-190.**

Introduction

Out of 49 m ha under salt affected soils in the South and Southeast Asia, about 27 m ha (55%) are within coastal areas. The coastal salt affected soils due to various soil fertility constraints like high salt content and pH causes changes in solubility, availability and efficiency of plant nutrient, poor physical condition of soil leading to low crop yields (Maji *et al*., 2004). In recent years, global attention is being given to develop non-conventional crops for salt affected soils. Under such situations, alternate cropping system such as utilization of medicinal plants can improve the economic conditions of the coastal farming community.

Senna is a small, perennial, branched under-shrub grown for its medicinal value of leaves and pods which contain sennosides A, B, C, D, rhein, aloe-amine, kaempferein and iso-rhein in free and glycosides forms (Gupta and Pareek, 1995). It is one of the most useful

purgatives, especially in case of habitual constipation. Besides being a laxative, senna is used in splenic enlargements, anaemia, typhoid, cholera, jaundice, rheumatism, tumours, foul breath and bronchitis, and probably in leprosy.

Fertilizer management is a key factor in the success of medicinal and aromatic plant cultivation. Restricted use of chemical fertilizer and inclusion of organic materials in soil fertility management is emphasized especially for medicinal plants production because of the ever increasing demand for organically produced herbs. Little or no information is available for the development of INM for senna in coastal sandy soil. Keeping this in view, the present investigation was carried out.

Resource and Research Methods

A pot experiment was conducted in the Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University during 2015 to study the effect of INM on the growth and yield of medicinal senna and on available nutrient status of soil. The initial soil was sandy in texture with pH 8.02 and EC 1.94 dS m^{-1}. The available NPK status were low, low and medium, respectively. The following treatments were evaluated *viz.*, T_1 – Absolute control, T_2 – Recommended NPK, T_3 – FYM alone @ 12.5 t ha^{-1}, T_4 – Vermicompost alone @ 4.0 t ha^{-1}, T_5 – 75 % NPK + FYM @ 12.5 t ha^{-1}, T_6 - 50 % NPK + FYM @ 12.5 t ha^{-1}, T_7 - 75 % NPK + vermicompost @ 4.0 t ha^{-1}, T_8 – 50 % NPK+ vermicompost @ 4.0 t ha^{-1}, T_9 – T_5 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3 %, T_{10} – T_6 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3%, T_{11} - T_7 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3%, T_{12} – T_8 + $ZnSO_4$ @ 25 kg ha^{-1} + humic acid foliar spray @ 0.3% in Completely Randomised Design with three replications. Medicinal senna was grown upto maturity. The growth characters like plant height, number of branches, leaves and pod and leaf yield were recorded. At harvest the soil samples were collected, air dried, processed and analysed for organic carbon and available nutrients *viz.*, N, P and K using the standard procedure as outlined by Jackson (1973).

Research Findings and Discussion

The influence of various treatments in enhancing the growth character *viz.*, plant height, number of branches and leaves of senna was well evidenced in the present study. Among the treatments, application of 75 % NPK fertilizer + vermicompost @ 4.0 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} with humic acid foliar spray ranked best in recording the highest plant height (43.6 cm), number of branches (16) and leaf number (171) (Table 1).

Table 1: Influence of INM treatments on the growth and yield of senna

Treatments	Plant height (cm)	No. of branches/Pl	No. of leaves/Pl	Pod yield (g / pot)	Leaf yield (g / pot)
T_1 Absolute control	22.4	5	92	12.52	20.96
T_2 Recommended NPK	31.3	8	136	19.96	34.24
T_3 FYM @ 12.5 t ha^{-1}	27.5	7	124	18.20	31.52
T_4 Vermicompost @ 4 t ha^{-1}	28.3	8	133	18.92	32.12
T_5 75 % NPK + FYM @ 12.5 t ha^{-1}	34.2	11	151	21.84	37.16
T_6 50 % NPK + FYM @ 12.5 t ha^{-1}	32.6	8	145	20.08	35.92
T_7 75 % NPK + vermicompost @ 4 t ha^{-1}	36.3	11	155	23.92	39.44
T_8 50 % NPK + vermicompost @ 4 t ha^{-1}	33.7	10	147	22.68	36.96
T_9 T_5 + $ZnSO_4$ @ 25kg ha^{-1} + humic acid foliar spray @ 0.3 %	39.5	14	166	26.48	42.72
T_{10} T_6 + $ZnSO_4$ @ 25kg ha^{-1} + humic acid foliar spray @ 0.3%	37.2	13	158	24.52	41.00
T_{11} T_7 + $ZnSO_4$ @ 25kg ha^{-1} + humic acid foliar spray @ 0.3%	43.6	16	171	29.36	45.88
T_{12} T_8 + $ZnSO_4$ @ 25kg ha^{-1} +humic acid foliar spray @ 0.3%	37.8	13	162	25.84	43.32
S.E.±	1.51	0.51	3.18	0.60	1.15
C.D.(P=0.05)	3.04	1.02	6.37	1.22	2.31

Growth attributes are considered to be an important factor to judge the vigour and yield of a crop. In improving the growth characters, the INM treatments, application of 75 per cent RDF along with organic sources either as vermicompost or FYM ensured continuous supply of nutrient resulting in better growth (Panwar *et al.*, 2001). The increase in number of laterals resulted in more branches which might be attributed to sufficient quantity of nutrient flow in the plants treated with organic manures and humic acid as evidenced by Kale *et al.* (1987). Incorporation of vermicompost promoted plant growth due to the presence of auxin, cytokinin, vitamins and enzymes as reported by Atiyeh *et al*. (1999).

The number of pods per plant, pod and leaf yield of senna significantly increased due to the application of INM treatments. While recommended NPK recorded 19.96 g of pod and 34.24 g leaf yield per pot, the various INM treatments increased the pod yield to the tune of 21.84 – 29.36 g /pot and leaf yield to the tune of 37.16 to 45.88 g /pot. Of various treatments, application of 75 % NPK fertilizer + vermicompost + $ZnSO_4$ + humic acid foliar spray rated best in recording higher pod yield (29.36 g / pot) and leaf yield (45.88 g/ pot) followed by 75 % NPK + FYM @ 12.5 t ha^{-1} + $ZnSO_4$ + humic acid foliar spray. The sustained availability of nutrients throughout the cropping period, increased soil microbial activity and increased photosynthetic rate might have increased the yield (Singh, 2000 and Senthil Kumar *et al.*, 2003).

With the application of organic manure, the organic carbon content increased to 0.41 – 0.56 per cent in comparison to 0.21 per cent in initial soil (Table 2). Among the various treatments, 75 % NPK + $ZnSO_4$ + humic acid along with VC (0.56%) and FYM (0.54%) recorded a comparable content of organic carbon. In the present study, the application of vermicompost and FYM could contribute much towards the fertility status of soil due to their influence on soil physical and biological properties of soil. While control recording the lowest alkaline $KMnO_4$-N, Olsen –P and NH_4OAC-K content, the treatment 75 % NPK + VC + $ZnSO_4$ along with spraying of humic acid recorded the highest available nutrient status of 79.3, 5.09 and 149.5 mg kg^{-1}, respectively. In the INM treatments, the improvement in physico- chemical properties enhanced the nutrient availability in soil (Singh and Kumar, 2004). Further with the release of organic acid and chelation mechanism brought out by the decomposition of organics have solubilised different forms of nutrient in soil (Nazirkar and Kamthe, 2012).

It can be concluded that for increasing the growth and yield of senna in coastal sandy soil, INM involving

Table 2: Influence of INM treatments on the soil available nutrients (mg kg^{-1})

Treatments	Organic C (%)	Alkaline $KMnO_4$-N	Olsen- P	NH_4OAC-K
T_1	0.21	57.2	3.74	101.5
T_2	0.38	69.8	4.38	128.3
T_3	0.44	63.7	4.16	116.2
T_4	0.41	66.2	4.22	124.5
T_5	0.54	74.2	4.56	135.1
T_6	0.43	68.4	4.44	126.3
T_7	0.56	76.2	4.69	138.5
T_8	0.54	70.7	4.49	133.4
T_9	0.51	74.2	4.79	141.6
T_{10}	0.44	69.8	4.60	134.2
T_{11}	0.56	79.3	5.09	149.5
T_{12}	0.53	71.2	4.71	138.4
S.E.±	0.02	2.05	0.08	3.42
C.D.(P=0.05)	0.04	4.12	0.15	6.84

application of 75 % NPK + $ZnSO_4$ + humic acid along with VC / FYM could be beneficial.

Acknowledgement :

The authors acknowledge the Research Grant funded by National Medicinal plants Board, Ministry of Health and Family Welfare, GOI.

Literature Cited

Atiyeh, R.M., Subler, S., Edwards, C.A. and Metzger, J. (1999). Growth of tomato plants in horticultural potting media amended with vermicompost. *Pedobiologia,* **43** : 724-728.

Gupta, R. and Pareek, S.K. (1995). Senna. In K.L. Chadha and R. Gupta (Eds). *Advances in horticulture* Vol. **11**- Medicinal and Aromatic Plants. Malhotra Pub. House, New Delhi. pp. 325-336.

Jackson, M.L. (1973). *Soil chemical analysis*. Prentice Hall of India Pvt. Ltd., NEW DELHI (INDIA).

Kale,R.D., Bano,K., Sreenivas, M.N. and Bagyaraj,D.J.(1987). Influence of worm cast (Vee Comp. EUAS 83) on the growth and mycorrhizae colonization of two ornamental plants. *South Indian Hort.*, **35** : 433-437.

Maji,B., Panwar,N.R. and Biswas,A.K. (2004). Ecology and soil health of coastal ecosystem. *J. Indian Soc. Coastal agric. Res.,* **22** (1&2) : 35-42.

Nazirkar,R.B. and Kamthe, N.D. (2012). Effect of INM for pre-seasonal sugarcane on growth, nutrient uptake, biochemical composition and soil properties.*Asian J. Soil Sci*., **7** (1) : 89-92.

Panwar, A.S., Singh, N. P., Munda, G. C. and Patel, D.P. (2001). Groundnut production technology in hill region. *Intensiv. Agric.*, **6**: 7–9.

Senthil Kumar, B., Vasundhara, M. and Farooqi, A. A. (2003). Studies on dry matter production, nutrient uptake and quality in *Tagetus minuta* L. *Indian Perfumer,* **47**: 375–381.

Singh,B.L. and Kumar, A.D. (2004). Integrated nutrient management for sustained soil fertility and fertilizer economy in rice. *Indian J.Agric. Environ. & Bio-tech.*,**2** : 23-27.

Singh, V. P. (2000). Standardization of cultural practices in *Phyllanthus amarus* Schum and Thonn. M. Sc. (Hort.) Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).